IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In Re Application of John F. Grubb	:	
Group Art Unit 1795	:	FERRITIC STAINLESS STEEL HAVING HIGH TEMPERATURE CREEP RESISTANCE
Serial No. 10/602,945	:	
Filed June 24, 2003	:	Confirmation No. 1816
Examiner Tracy Mae Dove	:	

REMARKS FOR PRE-APPEAL BRIEF CONFERENCE

Sir:

In response to the June 5, 2008 final Office Action ("the Final Office Action") issued in the above application, Applicant requests a Pre-Appeal Brief Conference in accordance with guidelines in the "New Pre-Appeal Brief Conference Pilot Program" announcement appearing in the 12 July 2005 *Official Gazette*. In accordance with those guidelines, arguments for the conference are presented herein. Submitted concurrently herewith are: a Pre-Appeal Brief Request for Review (form PTO/SB/33); a Notice of Appeal; the fee under 37 CFR § 41.20(b)(1); and a Petition for Extension of Time and associated fee. Any deficiency or overpayment may be charged or credited, respectively, to Deposit Account No. 11-1110. The issues addressed herein are ripe for appeal in accordance with 37 CFR § 41.31(a)(1), and the claims have been subject to at least two rejections.

Arguments

In the Final Office Action, the Examiner rejects each of pending claims 36-40, 42, and 43 as being unpatentable under 35 USC § 103(a) over U.S. Patent No. 6,613,468 to Simpkins et al. ("Simpkins") in view of JP 2000-294256 to Taruya et al. ("Taruya"), "as evidenced by" U.S. Patent No. 5,424,144 to Woods ("Woods"). Applicant submits that the invention recited in the claims under examination does not result and would not have been suggested by the asserted combination of Simpkins, Taruya, and Woods. Applicant also submits that the record evidence of unexpected results confirms that the

claimed invention would not have been obvious. For at least those reasons, the rejections should be withdrawn and the claims allowed.

As discussed in Applicant's August 9, 2007 Response to Office Action, Taruya explains that the components of SOFCs (including interconnects) are not interchangeable with the same components from other types of fuel cells because of wide differences in fuel cell operating conditions. For example, paragraphs 0005 and 0006 of Taruya (emphases added) read as follows:

> [0005]: Although the aforementioned various types of fuel cells are referred to by the common name of "fuel cell", <u>when taking into account the constituent materials of each cell, they need to be regarded as completely different things.</u> This is because the presence of corrosion of constituent materials <u>due to the electrolyte used</u>, the presence of high temperature oxidation which begins to actualize from around 380°C, the sublimation and redeposition of electrolyte, and the performance demanded by the presence of coagulation, etc., particularly anti-corrosion resistance, is completely different for each fuel cell. In actuality, the materials used are various, ranging from graphite materials, to Ni-clad material, high alloys, and stainless steel.
>
> [0006]: <u>It is completely unthinkable to utilize the materials used in commercialized phosphoric acid fuel cells and molten carbonate fuel cells as the constituent material for polymer electrolyte fuel cells.</u>

The above passage pertains to <u>all other constituent materials of a fuel cell (including the interconnect) because of (due to) the electrolyte</u>. The choice of electrolyte drives the conditions, temperature and corrosion especially, in the fuel cell, which affects these other constituents. Taruya explains that it is "completely unthinkable" to use materials (including interconnects) from other kinds of fuel cells in polymer electrolyte fuel cells. One skilled in the art, after considering Taruya, would not have been motivated to use, and indeed would have been taught not to use, any of the constituent materials of the fuel cell described in Taruya in another type of fuel cell, especially one operating at a much higher temperature.

The Examiner cites Woods as showing "a separator suitable for use in various known types of fuel cells, such as solid oxide fuel cells and polymer electrolyte fuel cells." In essence, the Examiner attempts to disprove what is taught by Taruya regarding interchangeability of fuel cell components by citing to Woods. Any conflict between Taruya and Woods on this issue, at best, is evidence of the <u>unsettled</u> nature of the issue. The existence of any such <u>conflict</u> between the cited references is not sufficiently definitive to constitute a teaching, contradictory to Taruya, that "...the

interconnect (for a solid polymer fuel cell) of Taruya could have been used the interconnect (solid oxide fuel cell) of Simpkins", as the Examiner contends. Although Woods' column 1 (to which the Examiner cites) does refer to some use of ferrous metal separator plates, it also refers to disadvantages of using ferrous metals in molten carbonate fuel cells:

> In molten carbonate fuel cells, in particular, under fuel cell operating conditions, in the range of about 500°C to about 700°C, molten carbonate electrolytes are very corrosive to ferrous metals which, due to their strength, are required for fuel cell housings and separator plates. The high temperature operation of stacks of molten carbonate fuel cells increases both the corrosion and thermal stress problems in the wet seal area, especially when the thermal coefficients of expansion of adjacent materials are different.

One having ordinary skill in the art faced with the teachings of Taruya and contradictory teachings derived from Woods would not have been motivated to utilize the material of Taruya in the solid oxide fuel cell of Simpkins with any expectation that the interchange of materials would be successful. For at least this reason, the asserted combination of references fails to teach or suggest the invention recited in claim 36 of the Subject Application.

Applicant discussed record evidence of unexpected results in, for example, Applicant's February 29, 2008 Response to Office Action. Pages 5-8 of that response discuss record evidence clearly showing that the range of Nb, Ti, and Ta in the alloy composition recited in independent claim 36, which is $0.5 \leq (\%Nb + \%Ti + \frac{1}{2}(\%Ta)) \leq 1$ (the "Recited Range"), provides properties that are unexpected and surprising relative to compositions including a combined concentration of the three elements that is outside the recited range. As discussed in the Subject Application, six Nb-containing heats of ferritic stainless steel with the compositions set out in the table on page 21 of the specification ("the Table") were prepared. The heats' Nb concentrations were varied to provide heats falling within (heats WC71, 73, 74, and 75) and outside (heats WC70 and 72) the Recited Range. Relatively small increases in Nb concentration provided significantly and surprisingly improved creep resistance at SOFC operating temperatures, as well as significant improvements in microstructural stability and certain other mechanical properties.

As discussed on pages 6-8 of the February 29 response and on pages 28-39 of the specification, tested alloy compositions in the Table satisfying the Recited Range exhibited significantly improved creep resistance, which was especially significant at higher test temperatures. For example, alloys satisfying the Recited Range exhibited creep rupture strength of 400 hours at 1000 psi and 900°C, while the conventional alloys tested exhibited creep rupture strength of only 156 hours at lower pressure (900 psi). Alloys listed in the above table having compositions satisfying the Recited Range exhibited a time to 1% creep strain of at least 100 hours at 900°C under a load of 1000 psi. In contrast, the conventional alloys evaluated exhibited a time to 1% creep strain of only 2.5 hours at 900°C under a load of 900 psi. Also, the tested alloys satisfying the Recited Range exhibited a time to 2% creep strain of at least 200 hours at 900°C under load of 1000 psi. In contrast, the conventional alloys evaluated exhibited a time to 2% creep strain of only 5 hours at 900°C under load of 900 psi.

Pages 24-26 of the Subject Application's specification discuss the improvements in microstructural stability of the heats in the Table including at least 0.5% Nb. The alloy compositions in the Table that do not satisfy the Recited Range (WC70 and 72) readily recrystallized at 1750°F and also experienced significant grain growth at temperatures of about 1950°F and above. In contrast, the alloys in the Table satisfying the Recited Range did not show <u>any</u> evidence of recrystallization until heated to the substantially higher temperature of about 2000°F. Pages 27-28 of the specification as originally filed describe the unexpected and significant improvements in yield strength, tensile strength and hardness exhibited by the alloys in the Table that satisfy the Recited Range.

Given the inventor's understanding of the mechanism that may be responsible for the unexpected and substantial improvement in alloy properties resulting from increases in Nb concentration, the inventor further concluded that Ti and/or Ta may be included in the alloy, either along with or in place of Nb, in a combined concentration that falls within the Recited Range to achieve similarly significant improvements in the indicated alloy properties.

Therefore, adjusting the composition of a ferritic stainless steel alloy to satisfy the Recited Range provided a significant and unexpected improvement in several properties

Therefore, adjusting the composition of a ferritic stainless steel alloy to satisfy the Recited Range provided a significant and unexpected improvement in several properties including creep properties, microstructural stability, yield strength, tensile strength, and hardness. These significant improvements yield a ferritic stainless steel suitable for use as interconnect materials in SOFCs, which provides many advantages over conventional ceramic interconnect materials.

Thus, the asserted combination of references would not have disclosed or suggested the claimed invention. The Subject Application also clearly shows that alloy compositions satisfying the Recited Range exhibit unexpected, surprising, and significant improvement in several properties, including properties critical to materials used in SOFC interconnect applications. That the Recited Range results in these unexpected, surprising, and significant improvements clearly rebuts any *prima facie* case that may have been established by the cited combination of references.

Conclusion

Applicants respectfully requests that the claim rejections in the Final Office Action be withdrawn and that all claims under examination in the Subject Application be allowed.

Respectfully submitted,

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PRE-APPEAL BRIEF REQUEST FOR REVIEW

Docket Number (Optional): RL-1627DIV

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on ______________________

Signature______________________

Typed or printed name ______________________

Application Number	Filed
10/602,945	June 24, 2003

First Named Inventor: John F. Grubb

Art Unit	Examiner
1795	Tracy Mae Dove

Applicant requests review of the final rejection in the above-identified application. No amendments are being filed with this request.

This request is being filed with a notice of appeal.

The review is requested for the reason(s) stated on the attached sheet(s).
Note: No more than five (5) pages may be provided.

I am the

- ☐ applicant/inventor.
- ☐ assignee of record of the entire interest. See 37 CFR 3.71. Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96)
- ☐ attorney or agent of record. Registration number ______________________
- ☑ attorney or agent acting under 37 CFR 1.34. Registration number if acting under 37 CFR 1.34 52,497

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December 5, 2008
Date

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

☐ *Total of ________ forms are submitted.